Utilizing NASA Earth Observations to Model Present Distributions of Invasive Species in Alaskan Wetlands

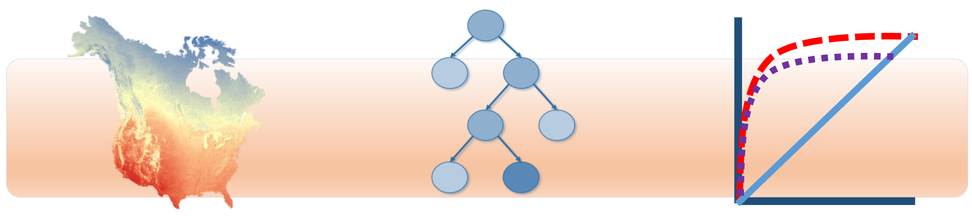
Abstract

The rapid expansion of purple loosestrife (*Lythrum salicaria*) and reed canarygrass (*Phalaris arundinacea L.*) into aquatic and wetland systems has reduced native plant abundance, decreased species diversity, and degraded wetlands habitats in North America. This trend is particularly concerning in Alaska, where wetlands are of major economic and ecological importance. The expansion of these invasive species into northern latitudes as a result of changing climate trends poses mitigation challenges to natural resource managers. This project developed habitat suitability models utilizing spectral data from Terra and Aqua MODIS in conjunction with topographic and climatic variables to map historic and current suitable habitat for purple loosestrife and reed canarygrass across Canada and the United States. The resulting habitat suitability maps will support decision making and the planning of management actions by partners at the Alaska Region US Fish and Wildlife Service in the "Early Detection, Rapid Response" program for invasive species management.

Objectives

- **Provide** the distribution of suitable niches on a continental scale for the invasive species reed canarygrass, and purple loosestrife (*Lythrum salicaria*) utilizing an ensemble modeling approach
- **Model** the current potential distribution of reed canarygrass (*Phalaris arundinacea L.*) in Alaska to provide a region-specific model that can be compared to the continental model that includes Canada, Alaska, and the continental United States
- **Create** reference maps to support invasive species management in Alaska
- **Produce** a tutorial for natural resource managers at the US Fish and Wildlife Service to reproduce the methods employed in this study

Methodology



Data Acquisition and Processing

Topographic data (SRTM)

Vegetation indices and land cover (MODIS)

Climate variables (ClimateNA)

Species presence data

Modeling

Habitat suitability modeling with predictors and presence data:

Boosted Regression Trees

Random Forests

MaxEnt

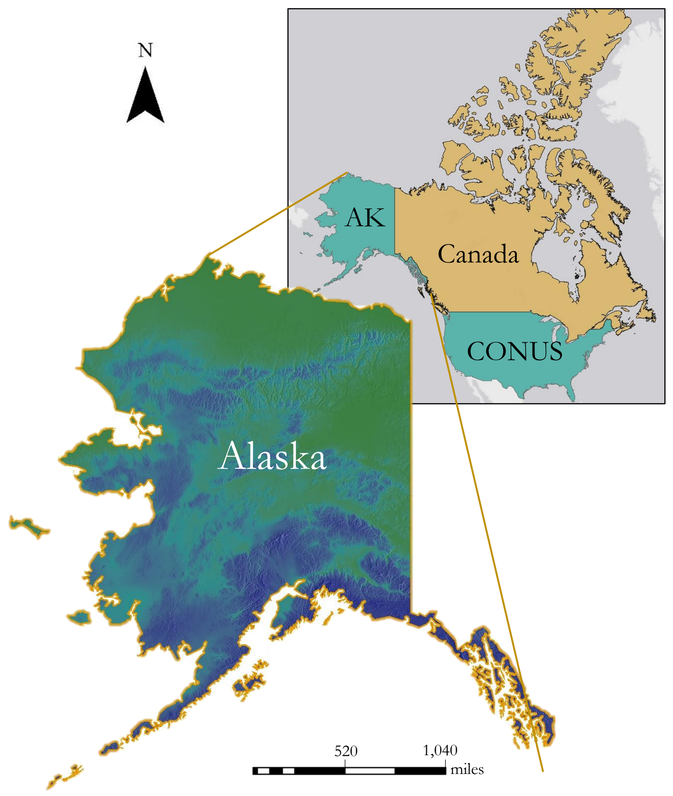
Results and Evaluation

Final model selections

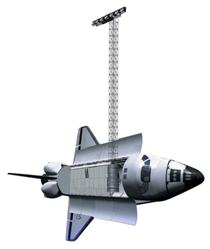
Ten-fold cross validation

Analyze statistical metrics to evaluate model performance

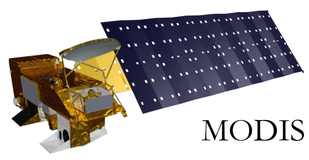
Study Area



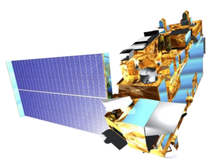
Earth Observations



SRTM V2



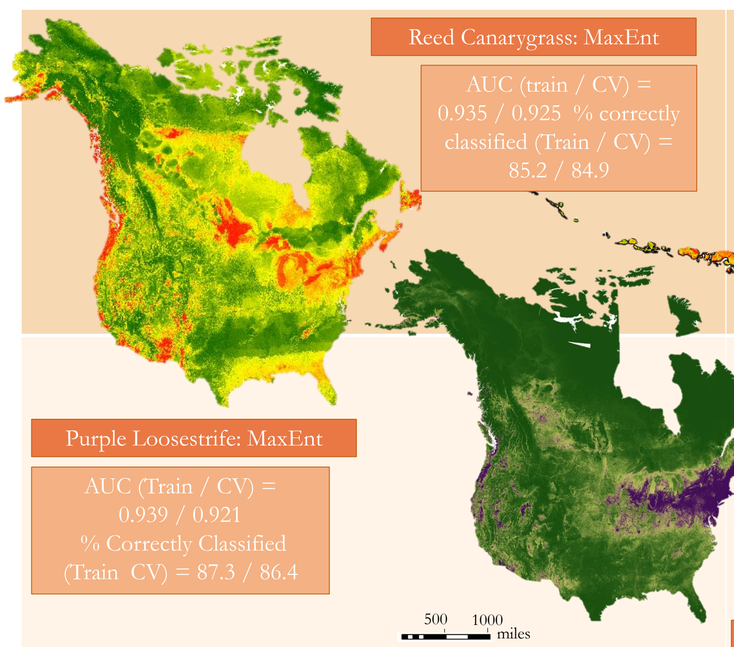
MODIS Terra



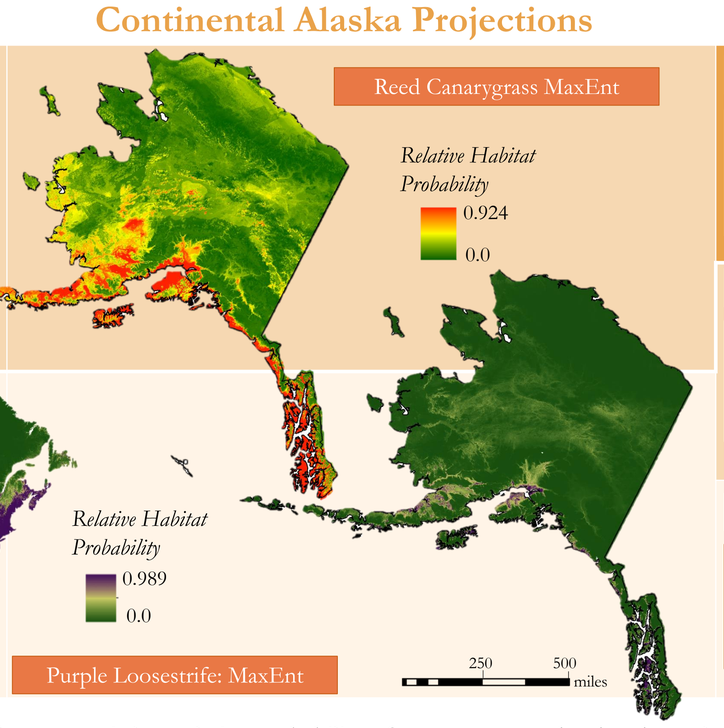
MODIS Aqua

Results

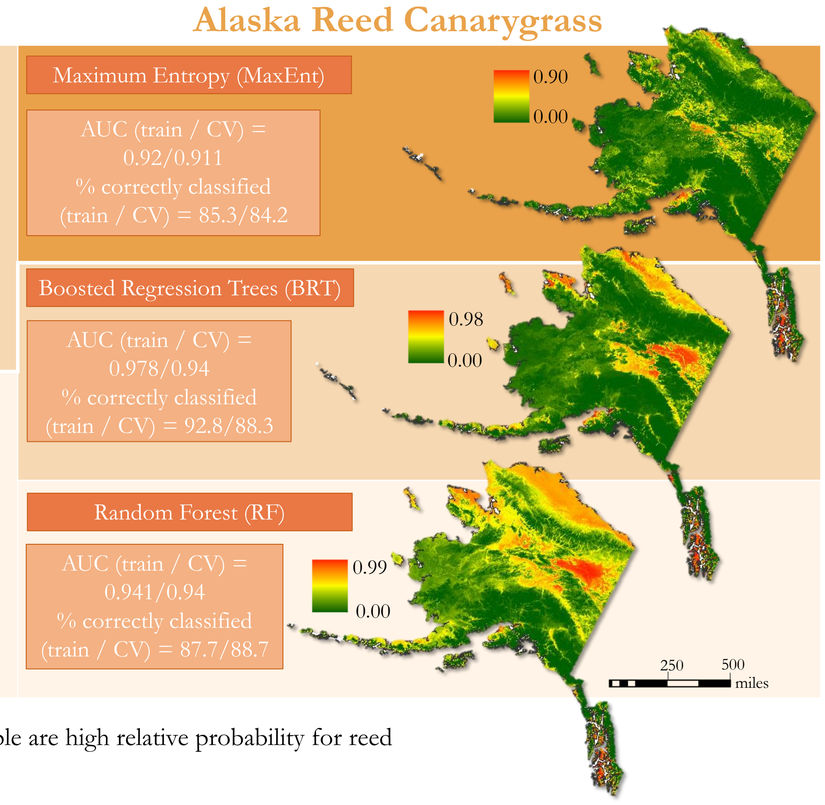
Continental



Continental Alaska Projections



Alaska Reed Canarygrass



Results displaying the relative probability of suitable habitat where green is low relative probability of occurrence, and red and purple are high relative probability for reed canarygrass and purple loosestrife respectively.

Conclusions

- Seasonal climate variables better explained species occurrences in artic regions like Alaska than annually averaged climate variables.
- Annually averaged climate variables generally underpredicted suitable habitat in Alaska, but were more informative in temperate regions at lower latitudes.
- Local input can be valuable in assessing the validly of model outputs, and can serve to inform the inclusion of the most ecologically relevant predictor variables for a given region in future, refined models.

Project Partners

U.S. FISH & WILDLIFE SERVICE

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Climate

Alaska

USGS at Colorado State University – Summer 2017

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